istic way by indicating the position of an imaginary observer by a colored bit of paper placed on the screen to the east of the diagramic cyclone and by moving the lantern in such a way that the storm center passes to the north, to the south, or directly over the observer.

A week of tri-daily non-instrumental weather observations opens the course in order to interest the student and to early cultivate the habit of observation of the weather changes that are daily and even hourly occurring. This is followed by a systematic study and construction of weather maps, step by step, through temperature, pressure, "wind and weather," as these subjects are taken up in class. Each element is worked out in a series of type maps. The elements are then correlated and their progression traced through a series of the maps of the Weather Bureau, so that when the subject of weather maps is reached in class it is simply reviewed, with emphasis on their practical and economic value. The forecasting of the weather from the maps leads to forecasting the current weather from personal observations. In this, the sons of those who "follow the sea" frequently combine experience with science and produce excellent forecasts. In connection with this later laboratory work lectures are given on "The Work of the Weather Bureau," and the course is concluded with a brief summary of the relations of weather and climate to human life.

It will be seen that the course as thus presented is for the general rather than for the special student, and as such offers an opportunity for combined scientific study and observation with most practical application to daily life.

A CHRONOLOGICAL OUTLINE OF THE HISTORY OF METEOROLOGY IN THE UNITED STATES OF NORTH AMERICA.

[*Concluded from the Monthly Weather Review, April, 1909.*]

1882. July. Three U. S. Signal Service men, Park Morrill, A. G. McAdie, and A. L. McRae, were assigned to study and observe atmospheric electricity under Professors Rowland in Baltimore, Md., and Trowbridge in Cambridge, Mass. This marked the inauguration of regular observations in this line of work at Johns Hopkins and Harvard universities. The general report on the subject was made by Prof. T. C. Mendenhall in 1887.

1882. August 10. Prof. William Ferrel was appointed assistant in the office of the Chief Signal Officer. He resigned on his seventieth birthday, September 3, 1886.

1882, 1885, 1887. A series of lectures by professors of meteorology at the Signal Service School at Fort Myer, Va., and subsequently at the Signal Office at Washington, D. C.

1883. Organization of the New England Meteorological Society, which continued in existence until April, 1896.

1883. Prof. Frank Waldo was sent to Europe to make a series of international comparisons between the standard barometers of the respective bureaus and those of the International Bureau of Standards at Paris, in order to secure international homogeneity in barometric work.

1884. Prof. H. A. Hazen took up the systematic study of thunderstorms.

1884. October. By cooperation with the U. S. Geological Survey the Signal Service undertook observations of earthquake phenomena, and a joint committee on seismology was appointed.

1884–1896. The American Meteorological Journal was started by Prof. M. W. Harrington in May, 1884, and continued under his editorship until 1891. Ginn & Company (R. DeC. Ward, editor) carried the Journal from 1891 to the end of the twelfth volume, when in 1896 publication was suspended.

1885. January 1. Prof. T. C. Mendenhall appointed assistant in the Office of the Chief Signal Officer, and assigned in charge of the Instrument Division. He resigned on October 30, 1886.

1885. Founding of Blue Hill Obs.

1885. June. Alexander G. McAdie makes quantitative studies in atmospheric electricity by means of kites at Blue Hill Observatory, Mass.

1885–1886. Profs. C. F. Marvin and H. A. Hazen compared the sling psychrometer with the dew-point apparatus at Washington, Colorado Springs, and Pikes Peak. The results were worked up by Prof. W. Ferrel and embodied in his tables for use with the whirled psychrometer.

1886. The Smithsonian Institution published "Recent Advances in Meteorology" by Wm. Ferrel.

1886. February. The first general Conference of Directors of State Weather Services was held at Washington, D. C.

1887. January 16. Gen. W. B. Hazen was succeeded by Gen. A. W. Greely (*b.* March 27, 1844) as Chief Signal Officer.

1887. All marine meteorological work under the supervision of the Signal Service was transferred to the Hydrographic Office of the U. S. Navy Department.

1887. May. The Weather Crop Bulletin, a revival of the Weekly Chronicle and the Farmers' Bulletin, began and was continued until 1906, when the title was changed to the National Weather Bulletin.

1888. The Signal Service published "Meteorological Apparatus and Methods," by Prof. C. Abbe.

1888. The system of ter-daily simultaneous weather charts changed to a system of semi-daily charts at 8 a. m. and 8 p. m., seventy-fifth meridian time.

1888. The Richard thermograph and barograph and a simple self-recording rain gage began to be introduced at the Weather Service stations.

1888. The cold-wave flag and many other signal devices were introduced, all of which were eventually reduced to a simple system of flag signals now called "Weather Flags."

1889. March. The necessary changes in the Ferguson house, prior to its occupation by the Weather Bureau, were completed on March 5 and on March 22 of this year the Washington station of the Weather Bureau was removed from its former quarters at 1709 G street NW. to the new permanent home on Twenty-fourth and M streets NW. Other divisions of the Bureau moved over at various dates.

1889. Prof. Cleveland Abbe devised, constructed, and distributed copies of his marine nephoscope as used by him on the *U. S. S. Pensacola*, 1889–1890.

1889, September, to 1890, May. The U. S. Scientific Expedition to the West Coast of Africa," otherwise called the *U. S. S. Pensacola* Eclipse Expedition, was conducted under the charge of Prof. David B. Todd of Amherst. Prof. C. Abbe was detailed as meteorologist. The expedition returned to the United States in May, 1890.

1889. September. Ferrel published his "Popular Treatise on the Winds."

1890. In this year "local forecasts" were begun at St. Paul, Minn. (Lieutenant Woodruff), and at San Francisco (Lieutenants Maxfield and Finley).

1890. October 1. The act transferring the meteorological work of the Signal Service to the Weather Bureau of the Department of Agriculture was enacted. This act went into effect July 1, 1891, and defined the scope and work of the Weather Bureau as follows:

The Chief of the Weather Bureau shall have charge of the forecasting of the weather; the issue of storm warnings; the display of weather and flood signals for the benefit of agriculture, commerce, and navigation; the gaging and reporting of rivers; the maintenance and operation of seacoast telegraph lines and the collection and transmission of marine intelligence for the benefit of commerce and navigation; the reporting of temperature and rainfall conditions for the cotton interests; the display of frost and cold-wave signals; the distribution of meteorological information in the interests of agriculture and commerce, and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States, or as are essential for the proper execution of the foregoing duties.

1891. July 1. At noon the Weather Service, its buildings,

telegraph lines, stations, apparatus, and men were transferred to the Department of Agriculture. On this date also Prof. Mark W. Harrington (*b.* 1848) was appointed Chief of the Weather Bureau of the Department of Agriculture.

1891. The Weather Bureau published "A General Summary of International Observations" as its Bulletin "A."

1891. The Smithsonian Institution published "The Mechanics of the Earth's Atmosphere," a collection of translations by Prof. Cleveland Abbe.

1892. A special service for the Lake region was established to include studies of the lake currents and to publish a semi-annual Lake Chart.

1892. August. The Second General Conference of the Directors of State Weather Services was held at Rochester, N. Y., in connection with the Association of American Agriculturists.

1892. The Division of Climatology and Hygiene of the Weather Bureau was established, with Dr. W. F. R. Phillips, Climatologist, in charge.

1893. Report of the "Committee of Ten" of the National Educational Association "On the Teaching of Meteorology in the Schools."

1893. Publication of Dr. Frank Waldo's "Modern Meteorology."

1893. August. Meeting of the International Meteorological Congress at Chicago, Ill. Some of the papers presented at this Congress have been published as Bulletin 11 of the U. S. Weather Bureau, while others still await publication.

1893. August 21. The Third Conference of Directors of State Weather Services was held at Chicago, in connection with the International Meteorological Congress.

1893. August. The International Congress on Aeronautics met at Chicago. At this Congress several memoirs on the use of balloons and kites in meteorological research were read; and at this date Professor Harrington ordered the development of the Hargrave kite and other work along these lines by the Weather Bureau.

1893. Extensions of the River and Flood Service of the Weather Bureau were made in this year and in 1899 and 1904.

1893. August. A permanent editor, Prof. Cleveland Abbe, appointed to the MONTHLY WEATHER REVIEW.

1894. Publication of Prof. W. M. Davis' "Elementary Meteorology."

1894. Establishment of a district forecast center at Chicago, Ill., with Prof. Willis L. Moore in charge. District forecast centers were subsequently established at Boston, New Orleans, Louisville, Denver, San Francisco, and Portland, Oreg.

1894. August 4. Mr. Eddy flew kites with thermograph at Blue Hill, Mass., Observatory, and kite work begins to develop rapidly at that place by S. P. Fergusson and H. H. Clayton, under A. L. Rotch, Director of the Observatory.

1894. August 17. The Third Annual Meeting of the American Association of State Weather Services was held at Brooklyn, N. Y., in conjunction with the meeting of the American Association for the Advancement of Science.

1895. July 1. The President of the United States appointed Prof. Willis L. Moore (*b.* January 18, 1856) to succeed Prof. M. W. Harrington as Chief of the Weather Bureau.

1895. October 16–17. The Fourth Annual Meeting of the Association of State Weather Services, held at Indianapolis, Ind.

1896. Suspension of the work of the New England Meteorological Society, which was organized in 1882.

1896–97. The international "Cloud Year" for simultaneous observations of clouds. The Weather Bureau cooperated by observing at a number of stations.

1897. Weather Bureau Bulletin "E," "Floods of the Mississippi River," by Park Morrill, was published.

1897. Establishment of a telegraph cable from Galveston to Mexican ports, and of three Weather Bureau stations at the Mexican cable stations.

1898. October 13–14. The First General Weather Bureau Convention met at Omaha, Nebr. [Succeeding the American Association of State Weather Services.]

1899. Publication of R. DeC. Ward's "Practical Exercises in Elementary Meteorology."

1900. January. Prof. Reginald A. Fessenden was appointed as expert in, and the Weather Bureau took up the development of wireless telegraphy.

1900. October. The Weather Bureau published the results of the "International Cloud Year" observations in the United States as prepared by Prof. F. H. Bigelow and others.

1900. November 1–3. First National Meteorological Congress of Mexico.

1900. December. Daily weather telegrams from Europe, were added to the morning daily weather map of the U. S. Weather Bureau; reports from Asiatic observatories were added later.

1901. August 27–29. The Second General Weather Bureau Convention met at Milwaukee, Wis.

1901. Publication of R. DeC. Ward's translation of Hann's "Climatology," Volume I.

1902. The Weather Bureau published "The Barometry of the United States," as prepared by Prof. F. H. Bigelow and others.

1902. Daily forecasts sent by wireless from Nantucket, Mass., to Cunard Line steamers.

1902. The Weather Bureau purchased land for a research observatory at Mount Weather, Va. Regular station work began there in the autumn of 1904. The administration building burned October 23, 1907, but was rebuilt in the summer of 1909.

1904. September 20–22. The Third General Weather Bureau Convention met at Peoria, Ill.

1904. December 1. The marine meteorological work of the Government was returned to the Weather Bureau by the U. S. Hydrographic Office, and the Weather Bureau relinquishes its work in wireless telegraphy.

1905. June 29. Maximum and minimum thermometers placed on the summit of Mount Rose, Nev. (altitude 10,800 feet), by Prof. J. E. Church, jr., of Reno, Nev.

1905. December 3. Daily wireless messages from ocean vessels began to be used by the U. S. Weather Bureau in compiling weather maps.

1906. Mount Weather Research Observatory near Bluemont, Va., opened by the Weather Bureau. The purpose of this observatory is to conduct research in meteorology and allied sciences as applied to the practical work of the Weather Bureau. The first bulletin of the Mount Weather Observatory was published in January, 1908.

1907. June. The inauguration of daily upper-air observations at Mount Weather and the utilization of their results by the Forecast Division at the Central Office.

1907. June. Evaporation observations at Reno, Nev., by Prof. F. H. Bigelow, H. L. Heiskell, and others.

1907. September 20. Wireless reports of the Greenwich mean noon observations from vessels on the North Atlantic were discontinued.

1907. November. Regular evaporation observing stations were installed at Indio and Mecca, Cal., by the U. S. Weather Bureau.

1908. Publication of Prof. Ward's "Climate in Its Relation to Man."

1908. Forecasts for periods of a week to ten days in advance, based on daily telegraphic reports from the Atlantic, the Pacific, Europe, Asia, and Alaska, were begun by the Weather Bureau at Washington.

1908. Organization of the Inter-Bureau Service for observations on evaporation and water resources.

1909. The first Bulletin of the "Mount Rose Weather Observatory" was published. The further prosecution of this work under Prof. J. E. Church, jr., was made possible by the cooperation of the Mount Rose Weather Observatory, the Nevada Agricultural Experiment Station, and the State University.

1909. Publication of Weather Bureau Bulletin "S," "Temperatures and Vapor Pressures of the United States," by F. H. Bigelow and others.

1909. The Weather Bureau began evaporation investigations at the Salton Sea, California.

1909. The Smithsonian Institution publishes "The Mechanics of the Earth's Atmosphere, II." a collection of further translations by Cleveland Abbe.

1909. July. Beginning with the issue for this month the MONTHLY WEATHER REVIEW changes its character and becomes a statistical survey of the weather. Professor Abbe is relieved of its editorship which passes to the Climatological Division under Professor Bigelow.

ADDENDA.

1836. J. P. Espy had been using wire in place of string for the kite cord for at least a year before this date.

1867. June. Cleveland Abbe, at Washington, D. C., studies the complex currents beneath thunder clouds by observing many kties flying simultaneously at various places and heights.

1871. December. The observations made on the balloon voyages of S. A. King are summarized by Prof. Cleveland Abbe and the law of change of wind with altitude deduced from them by him. He commends balloon work to the Chief Signal Officer.

1876. July. Prof. Cleveland Abbe determines, by means of kites, the altitude of the sea breeze on the coast of New Jersey.

1877. The Smithsonian Institution published "Short Memoirs on Meteorological Subjects," translations by Prof. C. Abbe.

1877. An outfit of pilot balloons, gas machine, and instructions how to use such balloons in determining the altitudes of the under sides of clouds, were furnished by Prof. Cleveland Abbe for the Arctic cruise of the schooner *Florence* (Capt. Geo. E. Tyson).

1879. July-August. S. A. King and Oray T. Sherman study the height and temperatures of the sea- and land-breezes at Coney Island, N. Y., by means of a manned captive balloon.

The end.

RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

C. FITZHUGH TALMAN, Librarian.

The following have been selected from among the titles of books recently received, as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies. Most of them can be lent for a limited time to officials and employees who make application for them. Anonymous publications are indicated by a ——.

Austria. K. k. Zentralanstalt für Meteorologie und Geodynamik.
Allgemeiner Bericht und Chronik der im Jahre 1907 in Österreich beobachteten Erdbeben. No. 4. Offizielle Publikation. Wien. 1909. x, 209 p. 8°.

Bombay and Alibag observatories.
Magnetical, meteorological, and seismological observations 1902 to 1905. Bombay. 1908. v. p. f°.

British association for the advancement of science.
Report ... 1908, Dublin. London. 1909. v. p. 8°.

Carnegie institution of Washington.
The California earthquake of April 18, 1906. Report of the State earthquake investigation commission. Washington. 1908. 2 v. Atlas. f°.

Craig, J. I.
Types of weather in Egypt. Alexandria. 1909. (Reprinted from "The Cairo scientific journal," no. 30, v. 3, March, 1909. 3 p.)

Davis, William Morris.
Atlas for practical exercises in physical geography. Boston. 1908. 45 pl. 8°.

Deutsche Südpolar Expedition 1901-1903.
... Hrsg. von Erich von Drygalski. 2. Band. Heft 3. Berlin. 1908. p. 225-298. f°.

Dry farming congress.
Formerly the Trans-Missouri dry farming congress ... Being a stenographic report of the proceedings of the third annual session of the congress held in Cheyenne, Wyo., February 23, 24, and 25, 1909 ... [Denver. 1909.] 360 p. 8°.

Dutch West Indies. Inspectie van den Landbouw.
Meteorologische waarnemingen ... Suriname en Curaçao ... 1908. [Paramaribo. 1909.] 16 p. 8°.

Eredia, Filippo.
L'alluvione nel versante orientale della Sicilia del novembre 1908, Roma. 1909. 20 p. 4°.
Ploggie torrenziali in Sicilia. (Dagli Atti dell'Accademia Gioenia di scienze naturali in Catania. Ser. 5. v. 2. 4 p.)

Finska vetenskaps-societeten.
Bidrag till kännedom af Finlands natur och folk. Häftet 64-66. Helsingfors. 1907-1908. 8°.
Öfversigt af ... forhandlingar. v. 48-50, 1905-1908. Helsingfors. 1906-1908. 8°.

Galitzin, B.
Hilfstabellen zur Auswerthung von Seismogrammen bei Anwendung aperiodischer Instrumente. St. Petersburg. 1908. 24 p. f°.
Seismometrische Beobachtungen in Pulkowa. 2. Mitt. St. Petersburg. 1909. 115 p. f°.

Germany. Deutsche Seewarte.
... Tabellarische Reiseberichte nach den meteorologischen Schiffstagebüchern. 6. Band. 1908. Berlin. 1909. x, 243 p. 4°.

Great Britain. National physical laboratory.
Report of the observatory department ... 1908. Teddington. 1909. 53 p. 4°.

Greely, A[dolphus] W[ashington].
Handbook of Alaska. Its resources, products, and attractions. New York. 1909. xiii, 280 p. 8°.

Heilprin, Angelo,
The eruption of Pelée. A summary and discussion of the phenomena and their sequels. Philadelphia. 1908. 72 p. xliii pl. f°.

India. Meteorological department.
Memorandum on the meteorological conditions prevailing before the southwest monsoon of 1909. Simla. 1909. 3 p. f°.

Indian association for the cultivation of science.
Report ... 1907. Calcutta. 1909. 65 p. 8°.

Keeling, B. F. E.
Climate changes in Egypt. (Cairo scientific journal. Alexandria. 1908-9.)

König, Fr.
Der Vertrocknungsprozess der Erde und Deutchlands verkehrte Wasserwirtschaft. Leipzig. 1908. 108 p. 8°.

Leyst, Ernst.
Luftelektrische Beobachtungen im Ssamark'schen Gebiet während der totalen Sonnenfinsternis am 14 Januar 1907. (Bulletin des Naturalistes de Moscou, no. 4, 1907. p. 493-528.)

Moscow. Kaiserl. Universität Meteorologisches Observatorium.
Beobachtungen ... 1907. Moscow. 1908. 4°.

Negro, C.
Contributo allo studio della dispersione elettrico-atmosferica. (Estratto dagli Atti della Pontificia accademia Romana dei Nuovi Lincei. Anno 62, Sess. 3 del 14 feb. 1909. 9 p.

Norway. Norske meteorologiske Institut.
Jahrbuch ... 1908. Kristiania. 1909. xii, 122 p. f°.
Nedboriagttagelser i Norge. Aargang 14. 1909. Kristiania. 1909. xvii, 130 p. f°.

Phin, John.
The evolution of the atmosphere as a proof of design and purpose in the creation and of the existence of a personal God ... New York. 1008. xiv, 191 p. 12°.

Saxony. Königl. sächsische Landes-Wetterwarte.
Wetterbericht. 1908. Dresden. 1908. n. p. f°.

Smithsonian institution.
Annual report. 1908. Washington. 1909. 138 p. 8°.

Société astronomique et météorologique de Port-au-Prince.
Bulletin annuel ... Année 1908. Port-au-Prince. 1909. 39 p. f°.

Soper, George A.
The air and ventilation of subways. New York. 1908. ix, 244 p. 8°.

Southport. Fernley observatory.
Report ... 1908. Southport. 1909. 29 p. 8°.

Steen, Aksel, S.
Havoverflatens temperatur ved Norges kyst. Kristiania. 1908. 17 p. 8°. (Archiv for mathematik og naturvidenskab. B. 29, Nr. 12.)

Trieste. I. r. Osservatorio marittimo.
Rapporto annuale 1905. 22 v. Trieste. 1909. 123 p. f°.

Wheeler, Joseph T.
The zonal-belt hypothesis. A new explanation of the cause of the ice ages. Philadelphia. 1908. 401 p. 8°.